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**SOME ASPECTS OF UNIDO'S
TECHNICAL ASSISTANCE ACTIVITIES IN THE SUGAR INDUSTRY***

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One of the problems faced by sugar industry in developing countries is its low price on the free market. There are several factors which may have contributed to this situation:

- from some 80 million tonnes in early seventies, the annual production of sugar has increased to close to 100 million tonnes in early and mid-eighties;
- introduction of sweeteners, other than sugar, particularly high fructose corn syrup, has resulted with stagnation or even reduction of sugar consumption in some developed countries;
- although sugar does not represent a major calory supplement in a daily diet, it is often the first one to be reduced by those who suffer from obesity and heart problems;
- due to economic problems and low buying power (living standard) in many developing countries, the consumption of sugar has not increased as expected; for many people sugar is still a luxury item which they can hardly afford;
- import restrictions and shortage of foreign exchange limit the consumption of sugar in some importing countries; increasing the consumption to the world average in only some of them, such as China and some African countries, would have considerable impact on sugar production and its price on the world market;
- support of domestic agriculture and sugar industry in some developed countries, with import restrictions, has resulted in a high price for the end consumer (several times higher than the free market price).

Due to these, as well as some other factors, there are sugar exporting countries trying to reduce sugar production while some importing countries

are increasing their production capacities. Under these circumstances, one can also note the tendency to:

- divert sugar production to alcohol in order to reduce surplus;
- reorganize and modernize (rehabilitate) sugar mills to operate as efficiently as possible;
- better utilize sugar industry by-products which in some cases may bring additional income to the sector.

This has also been reflected in technical assistance activities of UNIDO which is always based on official requests for assistance and therefore reflects to some extent priority criteria established by the Governments of the countries concerned. There have been several types of activities which are dominating:

1. Rehabilitation of sugar mills which are not operating efficiently and at full capacity, either because of outdated technology and equipment, shortage of spare parts, unskilled labour, or poor management, internal unrests, etc.
2. Better utilization of by-products, particularly bagasse (from sugar cane) and molasses, which may represent very useful raw materials for a variety of products, such as bagasse board, paper, furfural, yeast (both bakers' and fodder), alcohol (including rum), animal feed, organic acids, various chemicals, etc.
3. Rational energy utilization and therefore reducing the consumption of bagasse which, as a surplus, may be utilized for electricity and steam generation or for some other products.
4. Establishment or increasing the capacity of sugar industry development institutions which are involved in research and development activities as well as in training of industry personnel in specific skills.
5. Various activities related to the technological operation of sugar mills, maintenance and repair, corrosion prevention, manufacture of spare parts, etc.

Through years, technical assistance has been provided to a number of countries, such as Argentina, Cuba, Dominican Republic, Jamaica, Angola, Burundi, Congo, Mauritius, Morocco, Niger, Egypt, Syria, Lebanon, China,

Thailand, Viet Nam, etc. There were also meetings organized on the selection of equipment for the sugar industry, appropriate sugar technology for Africa, rational energy utilization in cane sugar industry, repair and maintenance of equipment in the sugar industry, and some other, more or less relevant to the sugar industry. All these activities, spread over many years, have had marginal effect on the development of the sugar industry, probably with a few exceptions of which some are only indirectly related to the sugar industry (bakers' yeast, animal feed, bagasse paper). In fact, considering the magnitude of investments, a number of people employed and the importance of the sector for some developing countries (Brazil, Cuba, Jamaica, Mauritius), all technical assistance provided so far could not make great impact on the countries' economy. However, it may have had an impact on some production aspects, either of sugar itself or of some products made from bagasse and molasses. The following are only a few examples:

- establishment of laboratories and pilot plant facilities for fermentation, biochemical additives and treatment of cellulosic material (bagasse), has resulted in the expansion of animal feed production based on bagasse and molasses (Cuba);
- identification of problems in bagasse board plant and recommendations on how to improve technology was aimed at improving the quality of boards for furniture industry (China);
- preliminary studies and assistance through expert services, enabled authorities to decide and go ahead with the establishment of cane sugar production (Morocco, previously only beet sugar producer);
- establishing bakers' yeast plant to supply yeast to the local bakeries should improve the quality of bread produced (Viet Nam);
- establishment of sugar development centre (Egypt) with a pilot plant and training facilities should contribute to upgrading the skill of plant personnel and apply some research and development results in practice;
- assistance provided in some very narrow fields of expertise, such as use of ion exchange for juice purification, introduction of computerized production control system, improving the yields in sugar, alcohol and yeast plants, have all one way or the other contributed to the better operation of the industry.

It might be interesting to mention two meetings organized by UNIDO and UNEP in one case, and UNIDO, GEPLACEA, OLADE and the Cuban authorities in the second case. The first meeting, Seminar on the Implication of Technology Choice in the African Sugar Industry, was held in Nairobi, Kenya, 18-22 April 1977. It dealt with social, economic, technological, investment, agricultural, environmental and energy aspects of sugar industry development. Comparison of small scale (open pan) and large scale (vacuum pan) sugar production was one of the main topics. It was interesting to note advantages and disadvantages of each system which should be carefully looked at before deciding on the establishment of new sugar plants. At that time, sugar production was still very attractive and there was considerable interest to establish new plants.

In principle, it was difficult to conclude that small open pan technology would be a better solution than large vacuum pan, and vice versa. Small plants are obviously less energy efficient, the quality of sugar is inferior, investments are small and employment per tonne of sugar produced is higher. Such plants may operate economically provided that labour wages are kept low. Also, there are regions and areas where infrastructure is adequate for large scale operations, unemployment is high and demand for quality is not particularly strong. Equipment manufacturers used to indicate that 3000 tonnes of cane per day capacity is minimum for economic and rational operation, this is probably based on the common size and capacity of individual pieces of equipment. Large scale operation is no doubt more energy efficient, quality of product is better, but requires very skilled operators for running and maintenance of the plant equipment, investments are high, etc. In many cases, the economics of sugar production for domestic market depend on the local sugar price determined by the Government authorities and import restriction. Sugar industry in many developed countries would not survive free competition from developing countries.

The second meeting, Latin American Workshop on Rational Energy Utilization in Cane Sugar Industry, was held in Cuba, 8-13 September 1980. When promoting the organization of such a meeting several years earlier, the response was not very enthusiastic. Sugar prices in 1974-1976 period were high and only late 1976, they fell down to a low level which everybody believed to be temporary. However, it is evident that this has not been temporary and in fact with some ups (1980/81) and downs, it has remained low until now. In any case, low prices of sugar on the free market in 1977-79 gave some thoughts to sugar exporting countries which realized that every effort should be made to reduce production costs, and rational energy utilization could be one of them, not so much directly but more indirectly. Particularly, if surplus bagasse could be utilized economically for the production of other products which the country may badly need and which may bring some additional income to the sector. It was realized that energy consumption (primarily thermal) could be reduced through the appropriate selection of technology, better control of steam boilers (high pressure versus low pressure), partial drying of bagasse with exhaust gases, better heat insulation of all thermal equipment and piping, heat recovery, etc. Energy inventory however, was considered as the first very important step which would enable exact determination of how much and where the energy is consumed.

It was suggested that similar meeting be organized for Asian countries and may be, later on, for Africa, however, due to financial constraints, no action has been taken so far.